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Using Grounded Theory Methods to Inform the Design of an Authoring Tool

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This paper presents and reflects on how Grounded Theory Methods (GTM) have enabled the construction of a conceptual framework for social story interventions, with the aim of informing the design of an authoring tool to support practitioners in developing social stories. Social stories are broadly used to enhance social interaction in children with Autistic Spectrum Conditions (ASC). The paper focuses on methodological issues rather than the outcomes. Five lessons have been drawn out with the intention of providing a guide for those who intend to apply GTM in order to inform the design of computer-based educational tools for ASC.

Grounded Theory Methods. Design. Authoring tools. Autism.

1. INTRODUCTION

Grounded Theory Methods “consist of systematic, yet flexible guidelines for collecting and analysing qualitative data to construct theories ‘grounded’ in the data themselves...” (Charmaz 2006, p.2). According to Glaser and Strauss (1967) Grounded Theory Methods (GTM) represent a rigorous set of practices for exploring a new domain or a domain which lacks a dominant theory. However, Grounded Theory (GT) is not just a set of procedures to be followed in a study, but an approach which supports the researcher to make sense of data (Charmaz, 2006) and offers methods to think about data (Glaser & Strauss, 1967) in an iterative way. Since Glaser and Strauss (1967) introduced GT in sociology, it has been adopted in other domains, being remodelled and adapted for various specific purposes. For example, in their study on various GT uses in Information Systems (IS), which included 126 empirical GT papers, Matavire and Brown (2008) identified four different approaches, as follows: a) “*Glaserian*” – a traditional inductive approach, that aims for extracting the theory from data, without established ideas and processes; b) “*Straussian*” – which introduces preconceived frameworks and theories, as well as more directed research questions; c) *mixed methodology* – which aims to combine GT with other research methods (e.g. activity theory or action research); d) *technique application* – does not fall in any of the previous categories, but makes sense of data by applying GT methods, such as open coding, axial coding, selective coding, memos and diagrams.

GT has been used in this study to analyse data which have been already collected with the number of participants being pre-determined. The reason why the authors chose GTM is because they constitute an effective and rigorous approach to

understand phenomena which have not previously been sufficiently explored (Saldana 2013).

The remainder of this article is structured as follows. Section 2 introduces social stories, including the Gray’s guidelines for effective social stories. The next section gives a description of the exploratory study which aimed to uncover practitioners’ procedures and practices while developing social story interventions. Section 4 explains how GTM made use of data collected during this study to build a conceptual framework for social story interventions. It shows also how this framework served to extract the design principles and the high level requirements for the authoring tool. The discussion is focused on the methodological issues rather than outcomes (the latter are presented in detail elsewhere). Lessons extracted from this study are presented in section 5. Section 6 contains the conclusions.

2. SOCIAL STORIES

One of the main difficulties for children with Autism Spectrum Conditions (ASC) is social interaction (Frith 1989). Social stories are a wide spread intervention which addresses this difficulty. The concept of social story was introduced by Carol Gray and defined as a short story with a specific style and format that describes a situation, a social skill or a concept (Gray 2004). Gray introduced a set of guidelines to support social stories development in order to obtain the best outcomes.

2.1 Gray’s guidelines

Social stories should meaningfully share social information, in a simple, literal way and should be customized to meet the distinct needs and skills of

the child. They contain six types of sentences, as it is shown in Table 1.

Table 1: Sentence types

Type of sentences	Description
<i>Descriptive</i>	<i>Factual statements, free of opinions or assumptions</i>
<i>Perspective</i>	<i>Describe a person's internal state, thoughts, feelings, beliefs</i>
<i>Cooperative</i>	<i>Identify what others will do to help</i>
<i>Directive</i>	<i>Identify a suggested response or a choice to a situation</i>
<i>Affirmative</i>	<i>Enhance the meaning of previous statements</i>
<i>Control</i>	<i>Identify strategies for recalling or applying information in social stories</i>

The **ratio** between the sentences should be 0 or 1 directive and control to 2 or more descriptive, perspective, affirmative and cooperative. Illustrations should be used when appropriate.

Using my Hands
I use my hands for a lot of things (<i>descriptive</i>). I use my hands to build Lego (<i>descriptive</i>). When I get cross I used my hands to hit people (<i>descriptive</i>). This will make people sad (<i>perspective</i>). When I am cross I should try to use words instead (<i>control</i>). Using words will make everyone happy (<i>perspective</i>).

Figure 1: Example of Social Story

2.2 Social Story Interventions

The main goals of educational interventions with individuals with ASC using social stories are to increase the individuals' understanding, to make them more comfortable and to provide the common appropriate responses in specific situations.

Computer-based interventions for children with ASC are particularly successful. Computers have been widely used to teach various skills to children with ASC, such as vocabulary and grammar skills (Bosseler and Masaro 2003), problem solving (Bernard-Opitz et al. 2001), reading and communication skills (Heinmann et al. 1995, Williams et al. 2002), social skills (Swettenham, 1996, Rajendran et al., 2005, Ramdoss et al. 2012).

In order to design a computer-based authoring tool for supporting social story interventions, an

exploratory study was conducted to explore the current practices in social story interventions.

3. EXPLORING CURRENT PRACTICES

A study to uncover the current practices in social story intervention was conducted with 4 practitioners who worked in special schools and had considerable experience in developing social story interventions for children with ASC. The practitioners (3 teachers and a speech and language therapist) were informed of the study purpose. They were asked to think about their procedures and practices in developing social stories, in advance of participation. The 2 hour study session took place outside of the school setting. Each practitioner was asked to write a social story (see an example in Fig 1). Practitioners were invited to express their thoughts aloud ('think aloud' protocol) while building the social story. Following this, semi-structured interviews were used to better understand the practitioners' experience and challenges when using social stories with children with ASC. The questions were mainly focused on:

1. steps that practitioners follow in social story interventions;
2. challenges the practitioners encounter;
3. materials and technologies used;
4. social stories format and content;
5. types of behaviours addressed by social stories.

The whole study was video recorded.

4. USING GTM TO MAKE SENSE OF DATA

The video transcripts for each participant along with the social story written during the study constituted a comprehensive and meaningful chunk of data. The data analysis followed the three coding methods commonly used in GT: open coding, axial coding and selective coding (Saldana 2013). Constant comparison and memos were used throughout the whole process of analysis.

4.1. Open Coding

This coding, called also initial coding (Charmaz 2006, Saldana 2013), seeks to identify concepts in data by closely examining discrete parts. It starts by using descriptive coding, process coding, attribute coding, in vivo coding, causation, or eclectic coding which combines two or more types of coding (Saldana 2013). According to Glaser and Strauss (1967), open coding uses constant text comparison which is a parallel process of coding and analysis. As codes and categories become

more and more numerous, constant comparison requires the researcher to think about data and to start conceptualising. In this process memos play a central role (see subsection 4.4).

4.2. Axial coding

In axial coding the open codes are clustered, based on the relationships between them. The concept of “axis” is understood as a category, “like the axis of a wooden wheel with extended spokes” (Saldana 2013, p.218). The data may need to be re-coded after discovering a new category.

4.3. Selective coding

At this stage the aim is to focus on a few more relevant codes which can grasp what “this research is all about” (Glasser and Strauss 1967, p.146). Saldana (2013) also states that theoretical coding (which is another name for selective coding) consists of finding the core categories which capture the gist of the research.

4.4. Memos

Memos are not simple notes written by the researcher, but a means to reflect on data, categories and connections. They prevent the analysts drawing premature conclusions about the new theory by slowing their pace and forcing them to reason throughout the research. Memos can be classified into: 1) **code memo** - a note regarding an emerging code or category; 2) **theoretical memo** – a note about the conceptual connection between categories; 3) **operational memo** – refers to future directions of the research study and data collection strategies.

4.5. Applying GTM

The research literature was reviewed before this study, but the reason was to prepare the researcher’s mind and not to force the data into a pre-set framework. Having a theoretical understanding of the social story interventions was helpful for example in preparing the questions for the semi-structured interview.

Now I will refer back to the first sentence about 'feeling angry' and give suggestion about what he can do when feeling angry, things he can do instead of hitting.
'When I am feeling angry I could go to my quiet corner. I could squeeze my bear'. (P1-teacher)
[Comment: Replace the bad behaviour with something that the child likes]

Figure 2: Sample from initial open coding

The coding process started by systematically reading each sample of data, identifying key words

and adding codes by using the “Comment” feature in Microsoft Word. An excerpt from the Word document is presented in Fig 2. Memos were useful to crystallise raw data into codes (see Fig 3).

10 September 2012-Finding alternatives/incentives

When writing a social story about negative behaviours the practitioner works for finding out alternatives to substitute that behaviour. For example, if the child hits other children and the story is meant to stop this behaviour, then the practitioner thinks of how to replace this behavior. In the first story, hugging the bear toy appeared to be an alternative, as the boy is fond of his toy. If the story is about positive behaviours, incentives are what practitioner is looking for by analysing the child’s abilities and interests. “Finding alternatives/incentives” seems to be an appropriate name for **open code**.

Figure 3: Example of code memo

In this study the open coding was conducted by using eclectic coding which combined attribute, descriptive, process, in vivo, and causation coding (see Table 2).

Table 2: Open code sample

Practitioner Statement	Open Code
his age is 8	1 Child age [attribute]
This boy has challenging behaviour.	2 Identifying the problem [process]
He often hits other children when he is stressed.	3 Stress>“Hits other people” [causation] [descriptive]>[in vivo]
So, I am going to call this story “It’s not appropriate to hit”.	4 Title [descriptive]
I always like to have a title for the social story so they know that this is what the story is going to be about.	5 Teaching with a title [process]

An Excel table was used, with the labels/codes on the first column and the samples of data for each practitioner on the other columns. So, once the open coding for a chunk of data was applied, the codes and the samples of data were written in the Excel table. The table permitted easy comparison between the labels and helped the researcher to find similarities and differences among practitioners. Some of the labels were merged while others were changed into more appropriate ones. The process was not linear. Thus, whenever a new code appeared, it was compared against the

other codes and often the data was coded again to reassure that the codes are close to the data.

61 initial codes were produced in the open coding stage. Based on the relationships between them, these codes were then clustered under a small number of categories using axial coding (Fig 4).

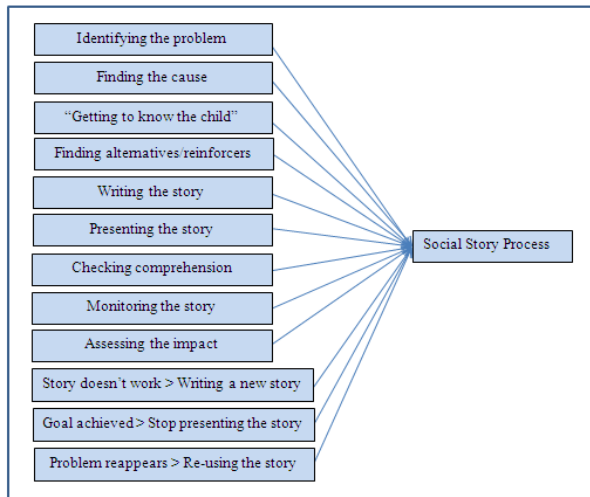


Figure 4: Example of axial coding

The research literature related to social story interventions was reviewed and included in the analysis to create links between research and practice. In this case the role of the literature was that of 'data'. It was compared with the emerging codes to be integrated into the conceptual framework. The main aim of axial coding was to find the core categories that describe social story interventions. Finally, four core categories were identified using selective coding (see Table 3).

Table 3: Core categories for social story interventions

Category	Description
Steps	Steps followed in the process of social story interventions
Challenges	Practitioners' challenges/concerns while working with social stories
Structure	The structure of the social story, including the format, length and content
Goals	The goals that social stories address

These core categories cluster into 21 subcategories (see Fig 6). Since the purpose of this analysis was to inform the design of a tool that supports practitioners in social story interventions, the selection was mainly based on how often the codes occur across different informants. For example, all the informants emphasized the

importance of following certain steps in the process of social story interventions. Therefore, it became obvious that an appropriate core concept is "Steps".

25 October 2012-Diagramming & Questions

After finally discovering the core categories I should think how to represent them in a diagram and to include the relationships among them. Diagramming is an important (see examples in "The Coding Manual for Qualitative Researchers" - Saldana)

Questions to think about:

- What are their implications on the present research?
- What are the main changes in the present research determined by this study? Why? ...

Figure 5: Example of operational memo

During the entire process of coding, memos have been written to help identify emerging codes, compare data, raise certain codes to conceptual categories or connect the categories. These memos were used to capture ideas, but also to think about the answers of various questions and to direct future research (see Fig 5).

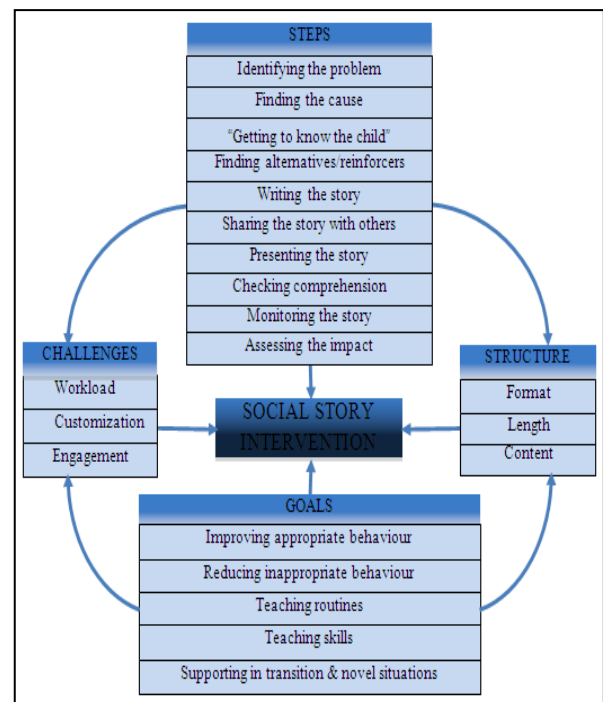


Figure 6: The conceptual framework of social story intervention

The next step was to find the relationships between the core concepts and to represent them diagrammatically (Fig 6). The exterior arrows suggest that challenges and content are determined by steps and goals, while the interior arrows suggest that the four concepts are part of social story intervention.

5. RESULTS AND IMPLICATIONS FOR DESIGN

Once the conceptual framework of social story interventions was created, the next step was to extract the information for the authoring tool design. Challenges were translated into design principles to guide the design of tools that aim to support social story development. The other core categories along with the corresponding codes were used to create a conceptual model for the social story authoring tools to meet these principles, as follows:

Ease practitioners' workload. A major challenge that practitioners encounter is the time spent in preparing educational materials. Although social stories seem to be less demanding than other educational strategies, the whole process of preparing, writing, presenting and assessing a social story is labour intensive. To address these problems, any support tool needs to be simple, intuitive and must help practitioners organise their work, and support the steps in the development process. The tool should allow them to write social stories from scratch (Fig 7), to reuse social stories, symbols and photographs and to monitor the impact of social stories on children (Fig 8, a). Data about the child's progress should be accessed and presented in various ways, enabling practitioners to get new insights into the child's behaviour and assess the success of the social story (Fig 9).

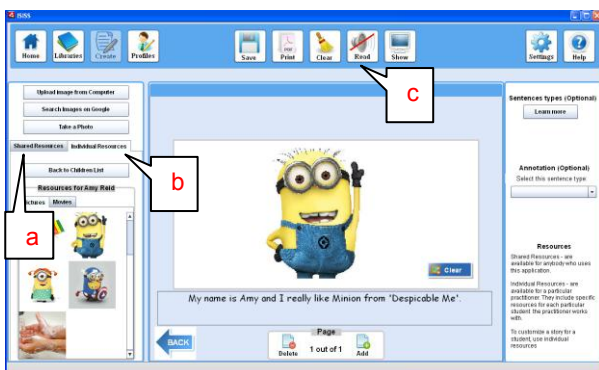


Figure 7: Creating a social story

Design for customization. A common concern is to quickly customize newly created or re-used social stories to the child's skills and needs. Users should be allowed to create sharable resources (Fig 7, a), resources for each child (Fig 7, b), to add their own social stories, symbols, photographs, rewards, as well as likes, dislike, strengths and skills, which should be accessible from the child's profile (Fig 8). The stories should also be customizable to the story topic content, be reusable and sharable with other practitioners and children. Text to speech capabilities (Fig 7, c) should be added to accommodate children with reading difficulties. Options to choose between various layouts should be provided.

Design for engagement. Another major concern is to create social stories which motivate children.

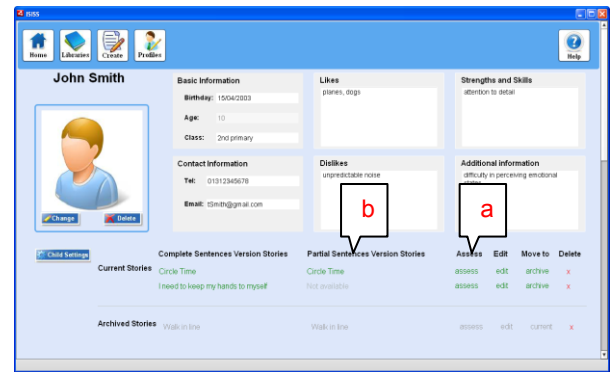


Figure 8: Child's profile

This could be met by customising the story to the child's needs, preferences, and familiar context (e.g. images of familiar people). Practitioners could add rewards at the end of social stories (e.g. animated characters, songs) adapted to each particular child. Social stories with partial sentences check comprehension, but may also make the system more interactive, potentially improving the child's engagement with the tool (Fig 8, b).

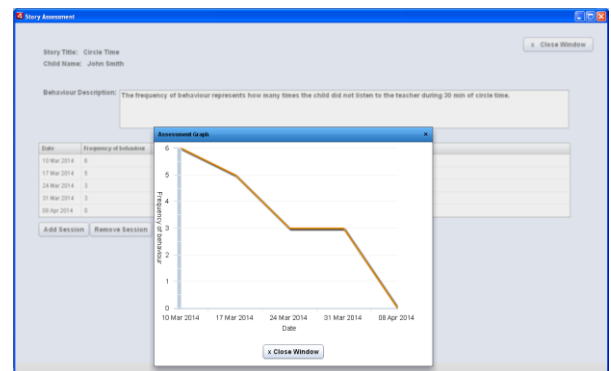


Figure 9: Assessing a story

Based on the conceptual model an authoring tool for social stories (Fig 7-9) has evolved through an iterative prototyping process.

5.1 Lessons Learnt

Five methodological and practical lessons have been drawn from the present study.

5.1.1. Review the related research literature before starting the study. It helps the researcher to understand the domain and to formulate the initial set of questions for the semi-structured interviews. The researcher can bring interesting questions and novel topics during the interviews which proved to make the discussion more vivid and motivational for the participants.

5.1.2. The interview must be open and friendly. Since the participants are experts in their field the interviews should be more like a dialogue where both the researcher and the practitioner are

interested to learn from each other. Caution should be taken when bringing into discussion research related topics that practitioners might not be familiar with. This may intimidate them and may lead to a less effective dialogue.

5.1.3. Start coding as soon as the first chunk of data is ready (being aware of the research literature, but not forcing the data into preset patterns). In this way, the subsequent interviews can be appropriately adapted to maximize the information from participants.

5.1.4. Combine unfocused with focused approach. In this study the coding started in an unfocused manner, by finding out initial codes which emerged from data. During the second stage of this study the researcher switched between a focused and an unfocused approach looking initially for two pre-established categories: *challenges and steps*. During the axial and selective coding, while new categories and concepts appeared, the coding moved towards a focused approach.

5.1.5. Reflect on the conceptual framework and draw out the design principles along with the conceptual model of the tool. Once the conceptual framework was created the challenges were translated into design principles. Then a conceptual model to meet these principles was built based on the other core concepts.

6. CONCLUSIONS

GTM can be successfully used to inform the design of educational tools for ASC. This article highlights how GTM were applied to extract the design principles and the conceptual model to inform social stories authoring tools based on empirical data, collected during think aloud observations and semi-structured interviews with practitioners. GTM not only help make sense of the data in a rigorous way, but also allow the researcher to intertwine practice and theory. This is in line with the recommendations given by Parsons et al (2009) to bridge theory and practice when designing technology for autism. This study provides several lessons that may be useful for designers who employ GTM to inform the design of computer-based educational tools for ASC.

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